

Utah State University

DigitalCommons@USU

Economic Research Institute Study Papers

Economics and Finance

1999

The Effect of Capital Market Imperfections and Intertemporal Choice on the Valuation of Retirement Fund Contributions

W. Cris Lewis
Utah State University

Tyler J. Bowles
Utah State University

Follow this and additional works at: <https://digitalcommons.usu.edu/eri>

Recommended Citation

Lewis, W. Cris and Bowles, Tyler J., "The Effect of Capital Market Imperfections and Intertemporal Choice on the Valuation of Retirement Fund Contributions" (1999). *Economic Research Institute Study Papers*. Paper 159.

<https://digitalcommons.usu.edu/eri/159>

This Article is brought to you for free and open access by the Economics and Finance at DigitalCommons@USU. It has been accepted for inclusion in Economic Research Institute Study Papers by an authorized administrator of DigitalCommons@USU. For more information, please contact digitalcommons@usu.edu.



Economic Research Institute Study Paper

ERI #99-09

**THE EFFECT OF CAPITAL MARKET IMPERFECTIONS
AND INTERTEMPORAL CHOICE ON THE VALUATION
OF RETIREMENT FUND CONTRIBUTIONS**

by

W. CRIS LEWIS

TYLER J. BOWLES

**Department of Economics
Utah State University
3530 Old Main Hill
Logan, UT 84322-3530**

March 1999

**THE EFFECT OF CAPITAL MARKET IMPERFECTIONS
AND INTERTEMPORAL CHOICE ON THE VALUATION
OF RETIREMENT FUND CONTRIBUTIONS**

**W. Cris Lewis, Professor
Tyler J. Bowles, Lecturer**

**Department of Economics
Utah State University
3530 Old Main Hill
Logan, UT 84322-3530**

The analyses and views reported in this paper are those of the author(s). They are not necessarily endorsed by the Department of Economics or by Utah State University.

Utah State University is committed to the policy that all persons shall have equal access to its programs and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

Information on other titles in this series may be obtained from: Department of Economics, Utah State University, 3530 Old Main Hill, Logan, Utah 84322-3530.

Copyright © 1999 by W. Cris Lewis and Tyler J. Bowles. All rights reserved. Readers may make verbatim copies of this document for noncommercial purposes by any means, provided that this copyright notice appears on all such copies.

**THE EFFECT OF CAPITAL MARKET IMPERFECTIONS
AND INTERTEMPORAL CHOICE ON THE VALUATION
OF RETIREMENT FUND CONTRIBUTIONS**

W. Cris Lewis and Tyler J. Bowles

ABSTRACT

The conventional approach to determining the pecuniary damages in personal injury litigation is to discount future wages to present value using a discount rate based on current or historic interest rates on Treasury securities. In addition to overcompensating the plaintiff by providing a set of choices that could not otherwise be obtained in a world characterized by imperfect and incomplete capital markets, the degree of overcompensation is even greater when valuing employer contributions to a retirement program. This is the result of: (a) the restrictive nature of qualified retirement plans that greatly reduce their liquidity; (b) the retirement fund may be invested in risky assets; and (c) the portfolio of assets may not meet the Markowitz efficiency standard. Two major themes are developed. First an analysis is made of the welfare gains to an individual who is awarded a large sum to replace future employee retirement contributions as a result of being able to access the capital market and to choose an efficient portfolio. Second, an analysis is made of the gains from being able to reallocate consumption intertemporally.

THE EFFECT OF CAPITAL MARKET IMPERFECTIONS AND INTERTEMPORAL CHOICE ON THE VALUATION OF RETIREMENT FUND CONTRIBUTIONS¹

Introduction

The conventional approach to determining pecuniary damages in personal injury litigation is to project wages and fringe benefits over some appropriately defined future period, adjust for the probability of being alive and in the labor force, and then discount to present value using a discount rate that is usually based on some weighted combination of interest rates on Treasury securities.² Romans and Floss (1996) have demonstrated that this approach applied to appraising lost wages (i.e., by discounting a projected stream of wage earnings using a risk-free interest rate) will result in a lump sum that overcompensates the plaintiff by providing a set of choices that could not otherwise be obtained in a world characterized by imperfect and incomplete capital markets.³ As demonstrated below, the degree of overcompensation is even greater in the case of valuing the employer contribution to a retirement program because: (a) the restrictive nature of “qualified” (i.e., tax-sheltered) retirement plans greatly reduce their liquidity prior to retirement; (b) the fund may be

¹The authors are Professor and Lecturer, respectively.

²The literature is replete with articles on what should be the basis for the discount rate, and there seems to be a consensus that yields on Treasury securities (i.e., the safest securities within any maturity class) should be used. There remains substantial controversy concerning which maturity is appropriate. Some argue for using the rate on Treasury bills while others argue for some type of average rate across maturities. Among the more recent articles see Johnson and Gelles (1996) and Gamber and Sorenson (1993).

³People cannot borrow the present value of their entire lifetime earnings, although they can borrow part of it. For example, mortgage lenders often use various rules to establish lending limits such as 2.5 times annual income or limiting debt service costs to 30 percent of income. For the younger worker, such rules effectively limit borrowing to a small percentage of the present value of lifetime income. For example, using the 2.5 times annual-income rule would limit borrowing for a 30-year-old male to approximately 10 percent of the discounted value of future wage earnings.

invested in risky assets; and (c) the portfolio of assets may not meet the Markowitz efficiency standard.⁴

We first analyze the welfare gains to an individual who is awarded a lump sum to replace future employer retirement contributions (calculated using a riskless discount rate) as a result of being able to access the capital market and choose an efficient portfolio. Next, we concentrate our analysis on the gains from being able to reallocate consumption intertemporally.

Gains from Enhanced Portfolio Choice

Appraisals of impaired earning capacity generally include a component for employer-provided fringe benefits. (For example, see Frasca 1992, and Lambrinos 1987). A typical procedure is to inventory these benefits and estimate their present value as a percentage of the present value of lost wage earnings. In the absence of detailed information on these benefits, some sort of national average of benefits as a percentage of income often is used. (See U.S. Chamber of Commerce 1996, Orlowski 1995, Norwood 1988, and Bureau of Labor Statistics 1993).

Often employer contributions to a retirement fund are a major component of the benefit package. But these programs have characteristics that indicate that the periodic contributions should be discounted at rates significantly higher than those conventionally used. For example, the assets in the retirement fund are almost totally illiquid—generally, they cannot be accessed until retirement occurs; they cannot be used as collateral for loans, although some plans do allow for limited borrowing from the account itself. Further, the fund may be invested in risky assets such as common

⁴Essentially, this is the set of portfolios that offer maximum expected return for a given level of risk. See Copeland and Weston (1988), Chapter 6.

stock, and the plan may not be fully vested in the worker for some years. Also, the plan may not be fully funded; the retirement plans at some firms have large unfunded pension liabilities, implying additional risk. Finally, the retirement fund may be invested in a portfolio that is inefficient. That is, given the risk of the portfolio, the expected return is less than on other portfolios with the same risk. In the extreme case of inefficiency, the assets are all invested in the common stock of the employer. This is very risky in that the individual has no diversification either in his human capital portfolio or in his retirement account. It simply is not logical to use a rate based on Treasury securities to discount the periodic contributions to such a plan.

The analysis in Figure 1 is used to demonstrate that the conventional appraisal approach overcompensates the survivor because it provides choices not heretofore available and neglects the risk factors associated with some retirement assets.⁵ The future value of the retirement fund (Y) is measured on the vertical axis and risk (σ) is shown on the horizontal axis. Consider the extreme case where the retirement assets are invested in the common stock of the employer (point A), which offers an expected fund Y_2 with a certainty equivalent of Y_1 . But A clearly is not an efficient portfolio in the Markowitz sense. By simply changing to an efficient portfolio (i.e., one with the same risk but higher expected return), point B is achieved that offers an expected retirement fund of Y_4 with certainty equivalent fund Y_3 and a welfare gain of $Y_3 - Y_1$ (or $Y_4 - Y_2$). This gain is from an enhanced portfolio choice.

⁵We assume that such issues as the consumption offset and income tax effects have been appropriately considered. Further, we assume that the survivor is able to invest on a tax-sheltered basis (e.g., in some sort of deferred annuity) so that the same tax deferral advantages of a qualified retirement account can be obtained. Bowles and Lewis (1995) have shown that this may not be true in some cases.

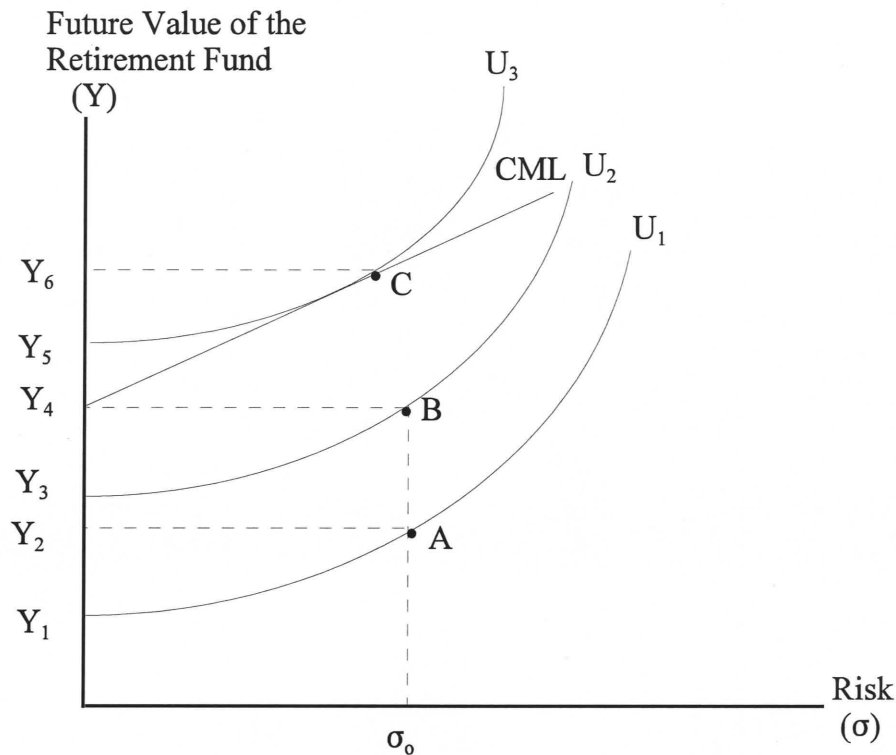


Figure 1. Gains from capital market access and enhanced portfolio choice.

By discounting at the risk-free rate, the plaintiff is awarded the present value of Y_4 and, effectively, the capital market has been made complete. The plaintiff now has available all combinations of risk and expected income shown along the capital market line, CML. Depending on the shape of the indifference curve map, he may choose to take more or less risk than σ_0 but, except in the case of extreme risk aversion,⁶ can always achieve yet another welfare gain. In Figure 1, the highest possible indifference curve (U_3) is reached at point C, which provides expected fund Y_6 with certainty equivalent Y_5 . Thus, the gain to capital market access is $Y_5 - Y_3$ (or $Y_6 - Y_4$).

For example, assume an employed person is rendered totally disabled by an accident and sues to recover pecuniary damages, including replacement of employer contributions to a defined-

⁶In that case, the entire fund would be invested at the risk-free rate and Y_4 is obtained.

contribution retirement program. Assume the assets are invested in a nonefficient portfolio, for which the risk is σ_0 and the expected rate of return is r_1 . The conventional appraisal of these lost retirement contributions measures the loss to the survivor as the present value of all future contributions discounted using the risk-free rate r_f , which is less than r_1 .

For simplicity, assume that the annual contribution is \$1,000, the worklife is 20 years, $r_1 = 0.04$, and $r_f = 0.02$. In the “no-injury” case, the fund (Y_2) is worth \$29,778 at the end of 20 years. In the case of injury, the court awards \$16,351, the present value of the 20 annual contributions discounted at r_f . The plaintiff now can invest the funds at r_f and withdraw \$1,000 each year to replicate the annual contributions to a retirement fund that now is invested in an efficient portfolio returning, say, $r_2 = 0.05$ with no increase in risk over the “no-injury” case. This fund would grow to an expected \$33,066 in 20 years. This future value is a measure of Y_4 and, hence, a gain of \$3,288 is achieved by being able to invest in an efficient portfolio.⁷

Now the plaintiff could choose to take additional risk (e.g., by investing the entire lump sum in the riskier asset at time period zero) and achieve a higher expected return, say, $r_3 = 0.07$. This plan has an expected future value of \$40,995 (Y_6), and there is an additional gain of \$7,929 attributable to capital market access that is essentially precluded in the usual qualified retirement plan arrangement. To take advantage of this opportunity, the injured person must take the additional risk of having the entire award amount invested in the higher risk asset initially as opposed to an initial investment in the risk-free asset followed by periodic withdrawals for investment in the higher risk asset. However, this option is not available if the person is not injured, and, in that sense, the injured person is made better off.

⁷The certainty equivalent amounts cannot be determined without knowing the individual's utility function.

Gains from Intertemporal Choice

It also can be shown that using the risk-free rate to calculate the present value of employer retirement contributions is too low because a lump-sum awarded to replace future lost employer retirement contributions allows the individual a greater range of choice between current and future consumption. Absent the injury, the individual could not have funded current consumption out of employer retirement plan contributions. Thus, there is a welfare gain associated with this enhanced opportunity set. *Ceteris paribus*, a higher discount rate (lower lump sum) is needed to place the individual on the same level of welfare he would have been able to achieve absent the injury.

This welfare gain is depicted in Figure 2. Here, consumption during the worklife period (C_0) is measured on the horizontal axis and consumption during retirement (C_1) is measured on the vertical axis. To abstract from the issues of the previous section, assume that had the person not been injured and, thus, had remained employed, he had the option to select an efficient portfolio and would have invested in a portfolio of Treasury securities which would have yielded r_f .

The present value of future employer retirement contributions discounted at r_f is represented by point A, and the slope of line AB is $-(1 + r_f)$. Had he not been injured, the individual is forced to use the entire retirement fund as future consumption, i.e., he must be on point B on indifference curve U_1 . Given the injury, the present value of the lump-sum award is point A, and the individual will rearrange present and future consumption to point C on the higher indifference curve U_2 . It follows that to leave the individual on the same level of welfare, a smaller lump sum (higher discount rate) should have been used to calculate the present value of lost employer retirement contributions.

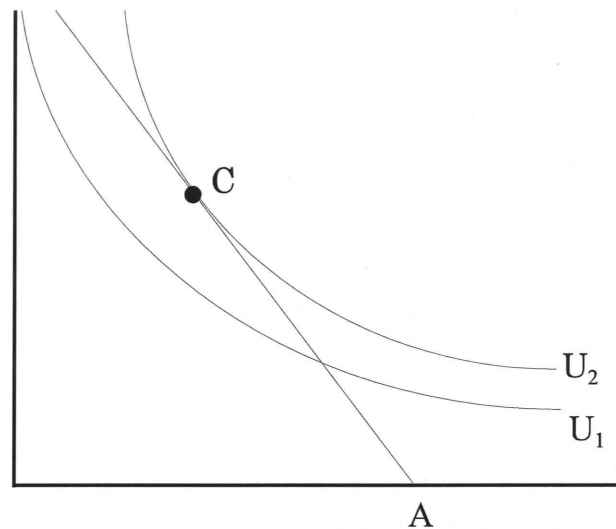


Figure 2. Gains from enhanced intertemporal choice.

Summary

Romans and Floss demonstrated that discounting wage earnings using the risk-free rate will overcompensate the plaintiff because it effectively opens access to the capital markets. We argue that the relative overcompensation will be even greater in the valuation of employer contributions to a retirement program. Conceptually, a premium should be added to the discount rate because, even in the best case, the restrictive nature of virtually all plans make them virtually illiquid until retirement thus reducing if not eliminating access to the capital markets; equivalently, welfare gains from increasing current consumption are made possible. In addition, there may be additional risk because the retirement program is not fully funded, and/or the assets are not invested in an efficient portfolio.⁸

⁸Six experts in the field of finance were asked to respond to the following problem which does not mention a retirement program but obviously indicates a situation equivalent thereto:

An amount of \$5,000 per year is contributed to a fund for each of the next 20 years that is invested in a diversified common stock portfolio with all dividends and realized capital gains reinvested. No funds can be withdrawn during the 20 year accumulation period nor can the fund be used as a

References

- Bowles, Tyler J., and W. Cris Lewis. 1995. "Estimating Lost Retirement Benefits: Tax Considerations." *The Journal of Legal Economics* 5(Winter):59-68.
- Bureau of Labor Statistics. 1993. *Employer Benefits in Medium and Large Private Establishments, 1991*. Bulletin 2422. Washington, D.C.: U.S. Department of Labor.
- Copeland, Thomas E., and J. Fred Weston. 1988. *Financial Theory and Corporate Policy*. 3rd edition. Reading, Mass.: Addison-Wesley Publishing Company.
- Frasca, Ralph R. 1992. "The Inclusion of Fringe Benefits in Estimates of Earnings Loss: A Comparative Analysis." *Journal of Forensic Economics* 5(Spring/Summer):127-36.
- Gamber, Edward N., and Robert L. Sorenson. 1993. "On Testing the Stability of the Net Discount Rate." *Journal of Forensic Economics* 7(Winter):69-79.
- Johnson, Walter D., and Gregory M. Gelles. 1996. "Calculating Net Discount Rates: It's Time to Recognize Structural Changes." *Journal of Forensic Economics* 9(Spring/Summer): 119-130.
- Lambrinos, James. 1987. "The Proper Valuation of Fringe Benefits in Economic Loss Studies." *Defense Counsel Journal* (October):527-30.
- Norwood, Janet L. 1988. "Measuring the Cost and Incidence of Employee Benefits." *Monthly Labor Review* (August):3-8.
- Orlowski, David. 1995. "Employer vs. Market Rate Theory In Valuing Benefits." Paper presented at the National Association of Forensic Economists session of the *Western Economics Association Annual Meeting*, San Diego, California.
- Romans, J. Thomas, and Frederick G. Floss. 1996. "Incomplete Markets and the Calculation of Economic Loss." *Journal of Forensic Economics* 9(Winter):17-22.

collateral for borrowing. At the end of the 20 year period, the funds can be withdrawn in roughly equal amounts per year for another 20 years. Additional returns are earned during the payout period and are factored into the annual payment. A lump-sum withdrawal during the payout period is possible but it is sufficiently disadvantaged by a tax penalty that it is not a real option. The question is: what amount of money today would make you indifferent between that amount and the arrangement described above? More specifically, what discount rate would you apply to the cash flows described above? (For your information, the current interest rates on Treasury bills and 10-year and 30-year Treasury bonds are 5.5%, 6.8%, and 7.0%, respectively.)

The median response was that a 14% discount rate should be used.

U.S. Chamber of Commerce. 1996. *Employee Benefits: Survey Data From Benefit Year 1995*.
Research Center. Washington, D.C.